Automation, what to do with it? Expedited Scientific Research and Reporting (ESRO) at the Belgian Health Care Knowledge Centre (KCE)

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Abstract
The Belgian Health Care Knowledge Centre (KCE) has explored the options offered by automation within the framework of the Expedited Scientific Research and Reporting (ESRO) methodological report, (on automation, methods to provide practical advice on the the use of Generative AI, methods to identify tools and applications for specific research purposes, etc.) with the aim of speeding up research processes without compromising the quality of studies. This article summarises the content of chapter 7 of this report, and complements it with a brief overview of the latest developments since the report publication, and the actions put in place at the KCE to ensure follow-up.

Key words: *methods; artificial intelligence; automation; storage and retrieval; operations research.*

Introduction

The Belgian Health Care Knowledge Centre (KCE) is an independent public health research agency, established in 2003 and funded by the Belgian federal authorities. Its mission is to support evidence-based policymaking in healthcare through scientific research and analysis, without engaging in political decision-making. All KCE products are publicly accessible, catering to policymakers, professionals, researchers, and citizens (1). All KCE studies are performed according to strictly codified procedures that are fully written out in our regularly updated Process Book (2).
To carry out its missions, KCE benefits from a documentation center that offers to researchers quick and efficient access to necessary information helping to deliver high-quality studies. Researchers also receive support from the information manager (in charge of the daily management of the documentation center), the information specialist (performing information retrieval for the research projects), and the knowledge manager.
Like similar health agencies, KCE faces the challenge of delivering good quality reports in a timely manner. During the COVID-19 pandemic, the already well-established process had to be accelerated, due to the growing number of urgent requests from stakeholders (such as political decision-makers). This situation led to the development of new approaches (3), searching sustainable solutions for the future.
Therefore, a formal reflection on how to expedite research processes at KCE was required, resulting in the production of a methodological report on Expedited Scientific Research and Reporting (ESRO) (3). ESRO was defined (3) as the use of accelerated scientific methods, while ensuring validity and quality. The potential for accelerating the research process was explored in several areas, including expedited literature reviews, expedited international comparisons, rapid qualitative research, and the integration of some degree of automation, where appropriate, in the overall research process.
We report in the following sections the main messages that can be derived from the ESRO report experience at KCE (full details can be found in the KCE Reports 386C, chapter 7 on automation): we will provide an overview on how the issue has evolved since the publi-

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cation of the report in July and we will give an outline of the work currently carried out at KCE to identify, assess and implement automation in the research process.

Exploring the potential for integration of automation in the research process

In October 2023, a dedicated working group was established, composed of three researchers with different backgrounds and specializing in different areas (health services research, health technology assessment or clinical guidelines), the information manager, the information specialist and the knowledge manager. The aim of the working group was to reflect and give practical advice on the potential for integration of automation in the research process.

The automation process as part of ESRO (*Table 1*) was explored by two approaches, identifying tools and applications that may accelerate the KCE project lifecycle (*Fig. 1*) and providing basic advice on how to use Generative AI (Gen AI).

Automation	Use of technology to conduct a task or process with a minimum of human intervention.
Artificial intelligence (AI)	Technology that enables computers and machines to simulate human intelligence and problem-solving capabilities.
Deep learning (DL)	Subset of machine learning that uses multi-layered neural networks, called deep neural networks, to simulate the complex decision-making power of the human brain.
Generative AI (Gen AI)	Deep-learning models that can take raw data and "learn" to generate statistically probable outputs when prompted.

Table 1. *Key concepts in the ESRO automation chapter.*

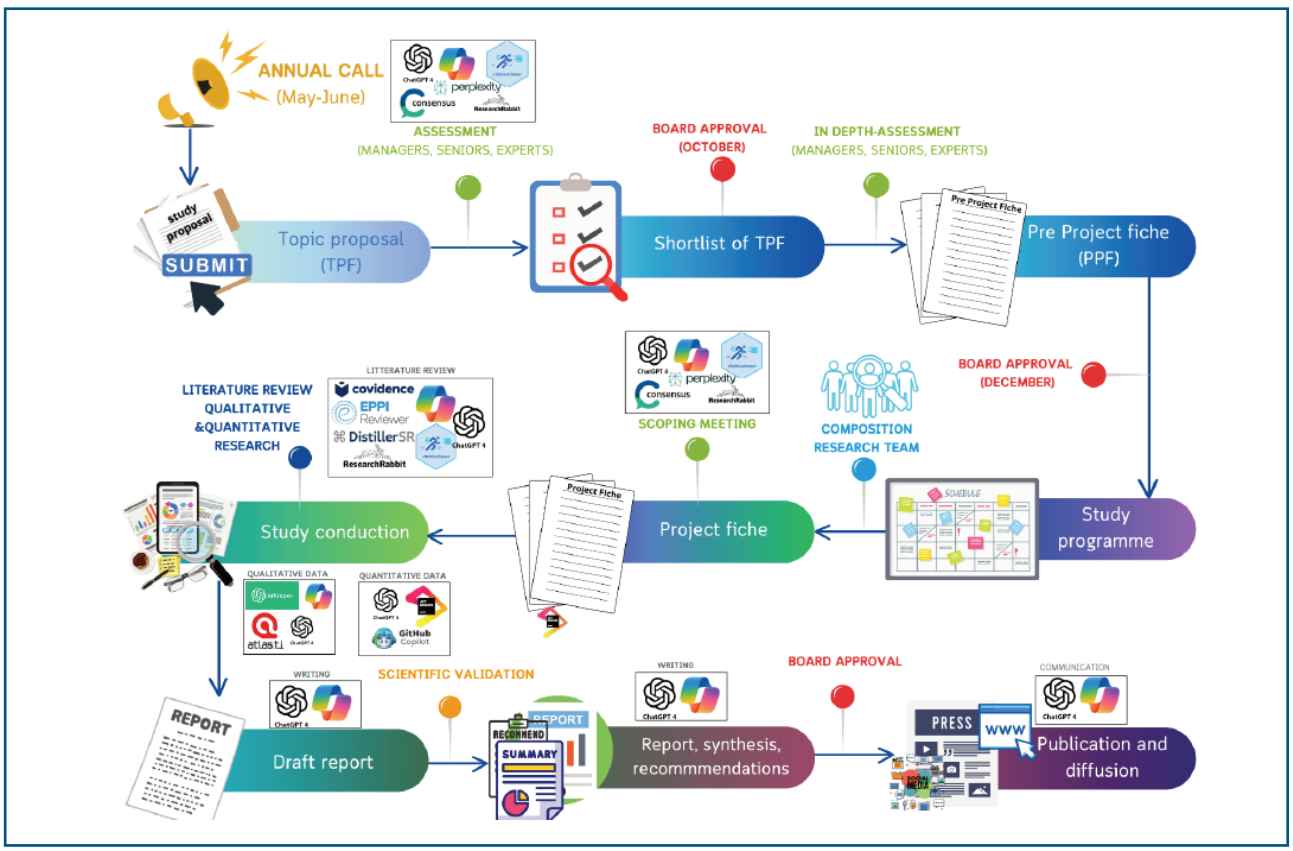

Fig. 1. *Automated tools of potential interest in the lifecycle of a KCE project.*

Tools to accelerate the KCE research process

Thirty-one tools that had the potential for accelerating the research process were identified. The research group collected candidate tools by brainstorming within the working group itself, searching the scientific and grey literature, checking information delivered by networks (websites, mailing lists, etc.), surveying Belgian academics and research organizations, and attending seminars, conferences or online courses related to the use of AI in scientific research (Appendix 1).

Each identified tool was then evaluated based on a predefined evaluation grid (*Table 2*) by one of the authors using a 5-point Likert-scale, where one consistently represents the worst possible score and five represents the best possible score.

From the shortlisted tools for potential further testing, thirteen tools were related to the retrieval and analysis of pertinent literature and scientific writing and eight were related to qualitative data collection and analysis.

Tools related to the expedited retrieval and analysis of pertinent literature and scientific writing served several purposes:

- **Management and streamlining of literature review:** Covidence, DistillerSR, EPPI Reviewer, Nested Knowledge, Systematic Review Accelerator. Those tools aim at assisting researchers in efficiently organizing, conducting and analysing literature. They offer features like reference management, data extraction, annotation capabilities and collaboration functionalities. They can save time and facilitate real-time collaboration.

Dimension	Definition	Points of attention
A. Resource saving	The tool/ application is likely to save (human) resources in the execution of the task compared with standard methods	
B. Reliability	The tool/application is likely to NOT introduce flaws in the results of the research process	
C. Liability	The tool/application is likely to NOT expose KCE to legal liability	Respect of GDPR Server located within the EU Secondary use of data Data Owner(s)
D. Learning curve	The tool/application does not require extensive training in competencies that cannot be found in-house	
E. User friendliness	The tool/application is easy to use	
F. Cost	The cost of the tool/application is likely to be proportionate to its usefulness	Unique purchase License type (annual fee/monthly fee/institutional fee/individual fee etc.) Frequency of tool update (impact cost)
G. Frequency of use	The tool/ application is likely to be used regularly/frequently at the KCE	

Table. 2. *Dimensions used to evaluate tools and applications for research automation. GDPR: General Data Protection Regulation.*

- **Automated quality appraisal:** RobotReviewer. These tools support the automation of a systematic evaluation of the quality and reliability of research study.
- **Forward and backward citation:** Citationschaser, ResearchRabbit. These tools complement article retrieval and reduce the risk of missing references using the classical key-word search. These tools can speed-up and diversify key literature retrieval during the scoping phase of a project. However an AI-assisted semantic search suffers from the lack of reproducibility.
- **Semantic search engine:** Consensus.app, Perplexity.ai. Those tools are designed to perform literature searches in a way that goes beyond keyword search, aiming to "understand" the context and intent behind a user's query.
- **PDF Data extraction:** ChatGPT4.Those tools allow to retrieve specific data from a PDF file. It can be tables, images, text or metadata.
- **Assistance in scientific writing:** Jenni.AI. Those tools provide style and content suggestions while redacting.

Tools related to the expedited data collection and analysis served two main purposes:

- **Audio transcription:** Amberscript, Happyscribe, Konch, SmartScribe, Trint, Whisper AI. Those tools convert audio or speech to text. They have the potential to reduce the time and resources required for the transcription of collected qualitative data (e.g., interviews, focus groups, meeting minutes).
- **Qualitative content analysis:** Atlas.ti, MAXQDA, Nvivo. Those tools support analysis of specific content like code generation for interview, summarizing selected passages, analysing coded segments.

Guidance

The working group developed guidance on the responsible use of Gen AI, on the effective use of prompts and on the use of LLMs in code generation. The guidance is not intended as exhaustive and should not be viewed as a final policy as it should be updated regularly in reaction of the rapid evolution of the field.
The guidance on the responsible use of Gen AI currently touches the following points:

- **Content authenticity.** It should be kept in mind that Gen AI tools are often trained on large, unmoderated bodies of text, such as text posted on the internet. This can result in the production of biased and other unintended content. Information checking of LLM's output is therefore mandatory.
- **Copyright.** Re-using content created with AI tools exposes therefore copyright issues, so checking the latest version of the terms and conditions of the LLM of choice, both regarding the use and storage of the input data and on the rights of use of output data.
- **Cite LLM Chatbots.** The nature and limitations of LLM chatbots should be taken into account and that they should be used for exploratory purposes and text refinement rather than content creation. When submitting a manuscript to a scientific journal, we recommend checking the author guidelines of the selected journal.
- **How to cite LLM chatbots.** If you are allowed to use LLM chatbots to help you write a manuscript, then we recommend checking the style guides to obtain information on the latest recommended format to use to cite LLM chatbots in your work.
- **Data security.** Confidential or sensitive information should not be provided to AI tools until the location of storage and computation is clearly defined (within EU) (4).

University websites were consulted to create a guidance note on the responsible use of Gen AI. In addition, the opinion of an external expert was sought.
The guidance on the effective use of prompts in LLMs (prompt engineering) touched the following points:

- the necessity of designing prompts;
- essential elements of instructions (context, input data and output indicator).

We outlined the following prompting techniques: zero-shots prompting, few shots prompting, Chain of thought prompting and prompt chaining.
This guidance was developed based on the material covered during an online course on the subject, attended by one member of the working group, and a pragmatic review of the literature.
Guidance on how LLMs can help in code generation touched the following points:

- how LLMs can be used for code completion and suggestion, debugging and error correction, code documentation and explanation, and learning assistance;

- advice on how large language models (LLMs) can support code generation was derived from first-hand experience and a pragmatic literature review.

The interested reader can find the complete guidance in Appendix 4. Automation, page 114 in the KCE Report (3).

ESRO Chapter 7: Discussion and conclusion

Within the lifecycle of a KCE research project, there are multiple opportunities for automation, which are not limited to literature reviews.

A wide range of software has been identified in the ESRO report. They all need a basic understanding of how they work to avoid part of the risks and biases, and to be sure that the response corresponds to the expectations of the researcher. Often, the key is the input that is given to the tool.

These news tools profoundly change the way KCE conduct projects and scientific researches. They require a great deal of attention to be used and integrated, to avoid losing the potential benefits they can offer.

Recent evolutions since the publication of the report

Since the publication of the report (July 2024), KCE started two pilots: the use of Covidence app on three projects as "Tools for streamlining systematic literature reviews". An access to Microsoft copilot has also been provided to all KCE researchers. And a local implementation of Whisper AI as "Audio transcription tool"

The AI transcription experiment aims to integrate OpenAI's Whisper, a state-of-the-art automatic speech recognition (ASR) system, with PyAnnote, a toolkit specialized in speaker diarisation (i.e., speaker recognition and attribution to specific audio segments). The objective is to assess the accuracy and efficiency of these two tools for in-house transcription of sensitive audio data. By combining these software solutions, we aim to establish a streamlined workflow for rapid and reliable transcription with clear speaker attribution. This experiment will support the development of a process for managing sensitive medical recordings, such as patient interviews, as well as scientific meetings.

Outside of the KCE, in a more general way, several interesting developments have appeared as the *AI Risk Repository* (5) from the Massachusetts Institute of Technology who can serve as a common frame of reference to understand the potential risks posed by AI to academics, editors, policymakers, AI companies, and the public or some consensus on how to describe references from Gen AI tools (6).

On a technical side, products such as Google Notebook LM (7) (beta version) directly integrate the "Retrieval-Augmented Generation (RAG) (8). It is already possible to see a generalization of this approach in specialized software's (IBM Watson Assistant, Agiloft.com, kirasystems.com etc.). RAG, originally introduced around 2020, reduces a part of bias and risks from LMMs by using a specific corpus of text defined by the end user. It transforms the tool itself in a high-speed filter. It offers a similar solution to an older approach to fine-tuning which can be described as the process of taking a pre-trained model and training it on a specific set of data to improve its performance in a specific task or domain. With the RAG solution, we can directly identify impact in the limitation of the information obsolescence and in the increase of precision.

Other recent developments were identified as the integration of "Function Calling" which permits external action on dynamic database or "Oversight Evolutive" (9), an adaptive technique of supervision to guarantee the reliability of the system. Similarly, we can highlight the "Self-Taught Reasoner approach (STaR) (10)" approach actually developed by OpenAI with GPTT-o1 (previous project Strawberry). It will enable the AI model to improve progressively its "Intelligence" by autonomously generating its own training data and by opening new perspectives in tools, functionality and capability. It can resolve advanced reasoning and complex problem.

LMM based agents (11) have also emerged mid-2024. They are basically working as if the AI disposes of a toolbox (module) and can use specific tools to resolve complex task. LLM based agents can act on feedback (or loop model) to refine the plan of action until the obtention of an acceptable answer.

In 2024, development mostly focuses on improving model architectures, processing efficiency, reasoning and interaction. This also includes the multimodal approach and the improvement of long-term memory.

On a legal side, the EU AI Act: first regulation on artificial intelligence was published the 12 Jully 2024 in the *Official Journal of the European Union* with 24

months to be implemented by the Member States (12). This regulation will have a huge impact on this sort of project and can be a key milestone in the integration of specific system for public, universities and researchers' organizations. It already needs to be monitored, analyzed and explored by the institution's legal experts and librarians alike.

Creation of the technological watch team

Given this rapid evolution, KCE decided to set up a technological watch team to identify, evaluate and integrate relevant tools in the lifecycle of its projects. This team will include researchers, information manager, information specialist and knowledge manager. It will work through multiple paths:

- organizing a monitoring system for specialized sources, blogs, and companies, complemented by a thorough web search using specialized software;
- continuous training on new tools, techniques or work approaches;
- creation of targeted documentation on the tools tested;
- creation of a shared online repository of efficient automated strategies that may be incorporated into our process such as data analysis code snippets or prompts of proven efficacy;
- working group and reflexion about responsible use of AI in research (development of guidelines for writing our report, disclosure in case of AI use etc.).

Conclusion

LLM based models, Gen AI or just AI are not more than gigantic collections of data. Therefore, librarians and information specialists are suited people to participate in the evaluation of such tools, and deliver recommendations on them.

In this way, KCE elaborated a methodological report including the automation processes that could serve for expedited research but also for other organizations in order to benefit from our experience.

Considering the constant evolution of this domain, the plethora of tools and their unpredictable future, real situation testing is important, as well as monitoring the evolution of the field.

AI is a field that will continue to be developed with the creation of the technological watch team, and we expect to integrate the best practices exchange at a national and international level in the future. EAHIL Special interest groups, mailing list and journal will play an important role in this scenario.

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APPENDIX 1

1) List of seminars, conferences and online courses attended

- IA and machine learning avec Micropole in 2024 (seminar) (https://www.digitalwallonia.be/fr/cartographie/micropole/)
- Strategizing AI in 2024: Copilot and what you need to know. SoftwareOne: 2024 Jan 30. (Webinar)
- Intelligence artificielle et KM. Share is in the air: 2024 Feb 02. (Seminar)
- AI en ChatGPT. EBPracticenet: 2024 Feb 15. (Seminar)
- Intelligence artificielle appliquée à la recherche documentaire. PMB Services: 2024 May 15. (Webinar)
- Intégration de l'IA dans les recherches. PMB-BUG: 2024 May 22. (Seminar)
- AI-assisted systematic literature reviews (SLRs) – Hope or hype? Perspectives from an end user on the future of AI-assisted SLRs. HTAi IRG: 2024 June 6. (Workshop)
- Automation and optimization of IR to support HTA. HTAi IRG: 2024 June 6. (Workshop)
- Revolutionizing systematic reviews? The role of ChatGPT in search strategy development. HTAi IRG: 2024 June 6. (Workshop)
- Prompt engineering, librarianship, and information literacy. Marydee Ojala. EAHIL2024 Conference. 2024 June 12 (Workshop)
- Benefits and limitation of automation and AI tools in research. Andrea Gasparini, Marydee Ojala, Simone Willis. EAHIL 2024 Conference: 2024 June 13 (Panel discussion)
- Exploring ChatGPT: Potential applications for designing systematic literature searches. Simone Willis, Mala Mann. EAHIL 2024 Conference: 2024 June 14 (Workshop)

2) Example of how to describe references from Gen AI tools. If the tool is used to support the redaction of text, it can be referenced as:

- A software: style: Author.(Year). Name of the software (month, day, version) [descriptor for the item]. URL
- A prompt result can be cited in two different ways:
  - when the prompt is placed in a document, we can refer to it as software name, prompt date, editor, URL;
  - if the prompt is not in the text of the document, we can refer to it as "full prompt". Name of software, version date, editor, URL.

Some recommendations include adding the full exchange with the Gen AI tool. However, Gen AI are not allowed as factual source of information due to the impossibility to reproduce the result.